



US Army Corps
of Engineers
Northwestern Division

Salmon Passage Notes

Snake and Columbia River Fish Programs

July 1997

Regional Round Table Meeting Features Drawdown Discussion

At the June 11 meeting of the Regional Round Table for the Lower Snake Feasibility Study, Steve Tatro walked the group through a fascinating backwards history of the making of four dams on the Lower Snake River. Tatro is among the Corps experts looking into the potential for a permanent natural river level drawdown of the four Lower Snake dams for improved salmon conditions. Using pictures taken during dam construction, Tatro, an engineer in the Corps' Walla Walla District, told how Lower Granite, Little Goose, Lower Monumental and Ice Harbor Dams might be dismantled, step-by-step, to allow the river to revert back to a free-flowing condition through this 140 mile stretch.

Showing a slide of the final stages of Lower Granite Dam construction, Tatro explained how tons of silts, sands and gravels were hauled in by the truckload to form the earthen embankment portion of the dam. This put the final blockage

reservoir by releasing water through the spillways and opening up the turbine passages—would be to remove that earthen portion of the dam.

At Lower Granite and Little Goose dams, removal of the earthen section of the dam would provide a free flowing stretch of river.



Tatro noted that drawing down Lower Granite and Little Goose dams would be more straightforward than the other two. At Lower Monumental and Ice Harbor dams, removal of the earthen portion alone probably would not be sufficient because of their smaller size. It may be necessary to

quantities of underwater gravels and rock near the new channel location. The Corps' preliminary estimate for permanent natural river level

drawdown construction costs for the four dams—about \$530 million—assumed that these costs would be similar at all four. Tatro expects to have a new estimate of the construction costs by the end of 1997. (The final report scheduled for 1999 will also include economic and mitigation cost estimates.)

The Corps is studying natural river level drawdown as one option for long-term improvements in migration conditions through the Lower Snake River, for three Snake River salmon species listed under the Endangered Species Act. Another option includes various combinations of major fish passage improvements that could be made such as gas abatement measures to allow spill with less gas supersaturation; modifications to the turbines to reduce injury to fish; and surface bypass systems to provide a new, and potentially more efficient, surface-skimmer type of juvenile bypass.

The Round Table meeting was the second in a series of meetings open to



To remove the earthen portion of a dam, material would be hauled out truckload by truckload reversing the dam construction process.



in the river, creating the reservoir that allows power production and navigation through the dam. The first step in reverting to natural river operation—after lowering the

remove portions of the spillways and open up the navigation locks to allow water to flow through and provide safe passage for salmon. Another option might involve removing hugh

all interested parties, to provide the region an opportunity to follow the progress of the study, ask questions, and provide input.

The theme of these meetings is “no surprises,” or at least very few surprises, according to Greg Graham, project manager for the study. “At the end of the study we hope that everyone who participates knows what was evaluated, how it was evaluated, and why it was evaluated.”

The Corps, National Marine Fisheries Service and the Northwest Power Planning Council have also formed a Drawdown Regional Economic Workgroup (DREW). This group includes representatives of states, other Federal agencies, the Tribes, and environmental groups and industry.

FOR FURTHER INFORMATION on the study or future meetings of the Regional Round Table or DREW call Dave Dankel at the Walla Walla District office, at 509-527-7288.

Hearings Look at Lower Snake and John Day Drawdowns

Two recent Congressional hearings, one held in Washington, DC and the other in Lewiston, Idaho, included discussion of drawdown studies of the Lower Snake River and John Day dams. Brigadier General Robert Griffin, Commander of the Corps Northwestern Division, was among those who testified at the hearings.

General Griffin told the attendees that the Corps is studying alternatives for improved salmon passage in a cooperative effort with others in the region. The detailed engineering, biological, social and economic analysis of alternatives for Lower Snake River dams will be completed in 1999 in accordance with the National Marine Fisheries Service biological opinion on hydropower operations.

The General also addressed the call for study of deep drawdowns of John Day Dam on the Columbia River. The Corps previously completed an evaluation of the effects and costs of drawing John Day down

to its minimum operating pool level—elevation 257 feet—for the duration of juvenile fish migration seasons.

General Griffin noted that the Corps is awaiting an okay from Appropriations Committees to begin study of deeper drawdowns at John Day during the remainder of FY97. The Corps has also requested funding in FY98 to continue study. The scope, level of detail, and schedule of the John Day studies would be developed in coordination with the region after Congressional okay to proceed.

Zebra Mussel Invasion

by Clare Perry, Public Affairs

When the innocuous-looking black-and white striped mollusks known as zebra mussels, find a home in the Columbia-Snake river



system, Corps biologist Jim Athearn warns that they will be a force to be reckoned with.

Athearn and other concerned scientists recently briefed the NW Power Planning Council and the Pacific Fisheries

Legislative Task Force on the potential extent and effects of a zebra mussel infestation. Major systems such as hydropower plants, fish passage facilities, navigation lock mechanisms, irrigation facilities, recreational and commercial boats could be greatly affected. This particular Eastern European freshwater mussel can alter ecosystems, disrupt industry, and cause millions of dollars in damage as many eastern and central states have discovered.

Scientists believe the mussel got its start in America about a decade ago when overseas ships unknowingly carried the mussel in freshwater ballast and discharged into the Great Lakes ports. In the past 10 years, the mussels have spread throughout the Great Lakes, connecting waterways, and numerous Eastern and Midwestern rivers and tributaries. Adult and juvenile zebra mussels are dispersed downstream not only by natural water movement but by an

ability to attach their tough elastic threads (byssal fibers) to nearly any surface, including animals, bait buckets, recreational boat hulls, and engine cooling water tanks.

Zebra mussels reproduce and colonize in huge numbers, building up an 8-12 inch thick colony inside freshwater pipes, community water treatment systems, power plant stations, navigation lock and dam structures, and other structures. As many as 700,000 per square meter have been observed.

This bivalve mollusc generally averages an inch in length with elongated shells typically marked by alternating light and dark bands or stripes. Each female mussel can produce as many as one million eggs per year and, within weeks, the microscopic offspring (about the size of a period) attach to a hard surface and begin to grow.

Though lakes and rivers may initially appear cleaner after zebra mussels have moved in, it is a deception that underlies the severity of the problem. Known for their filter feeding ability, each mussel can siphon up to two liters of water per day, pulling phytoplankton and other suspended solids from the water. This can be devastating to the aquatic food web and result in less fish and wildlife in the area. In Lake Erie, there are enough zebra mussels to filter the entire lake once every week!

More than 30 states have reported significant economic impacts occurring as a result of zebra mussel invasion, primarily in the East and Midwest. Of the 340 facilities which responded to a recent industry survey on zebra mussels, prevention and remediation measures had already topped more than \$69 million. Mississippi River lock operators reported that despite measures to fight zebra mussel infestation, the mollusks caused the closure of lock chambers and a backup of boat traffic for miles.

Athearn says it has been difficult to get some of the western states and municipalities, which haven't yet experienced a zebra mussel epidemic, to take the threat seriously. But interest is growing.

The Washington Department of Fish and Wildlife has concluded that Washington is at significant risk from

an introduction of the zebra mussel and declared it a deleterious exotic species. The department adopted new regulations to address zebra mussels coming in on recreational equipment from east of the Rockies, such as boats and trailers of tournament fishermen who follow competitions across the country. California has instituted boat inspections at border agricultural stations and has detected zebra mussels on eleven boats.

The federal government has already committed millions of dollars to combat the zebra mussel threat. The US Fish and Wildlife Service is sampling at Lake Washington and in the lower Columbia River for signs of the mussels. US Geological Survey's Columbia River Research Lab has an eye out for zebra mussels as it conducts other monitoring and research activities in the river. Waterways Experiment Station, a Corps research compound in Vicksburg, Mississippi, is the lead for the Corps' advance planning and monitoring effort.

Corps biologists at various projects are monitoring for any indications of zebra mussels in the turbine intake trash racks, fish passageways, boat ramps and wherever else they may hide. If colonies get established, cleaning and repair to dams, turbine screens, water supply and irrigation pipes, combined with the potential loss of power production, will be costly and time-consuming. The better course of action is to prevent the introduction of the nuisance species in the first place.

States must have action plans to combat the mussels to qualify for federal money to stop their spread. While Oregon and Washington have yet to qualify, biologists are also worried about the possible appearance of mussels in Montana and Idaho which could have devastating effects on the Clearwater, Snake and Columbia river systems.

"By the time you see them attached to these surfaces, we've got a problem," Athearn said. "Every state in the region needs to make contingency plans now, and concentrate efforts on public education and preventing the introduction and spread of zebra mussels into the Northwest."

Adult Salmon Returns

The region is breathing a tentative sigh of relief this year, with the encouraging numbers of adult spring/summer chinook salmon returning to the Columbia and Snake Rivers. At Bonneville Dam, the count up to June 30 this year was 132,735; about 2.2 times the '96 count and 1.5 times the 10 year average.



Biologists are careful when speculating about why the returns are good this year. Most of these fish migrated to the ocean in 1995, a year with a high number of juvenile fish outmigrating. But other factors played into the scenario as well.

Possibly the biggest factor is the one we cannot measure too well—ocean impacts. The El Nino event that has been partially blamed for poor returns in recent years receded, at least for a little while. El Nino events result in warmer water along the north Pacific areas off the coasts of California, Oregon, Washington, and British Columbia. The warmer water introduces other fish which prey on salmon or compete for food. It also adversely affects the food base for salmon because the west coast ocean upwelling, which propels nutrients up from the ocean floor, is diminished by the El Nino events. The most recent El Nino was also accompanied by drier conditions, although this is not always the case.

Improved freshwater habitat and river operations for fish probably also deserve credit for the improved numbers of returning adult salmon. The 1995 outmigration was aided by flow augmentation and spill requirements that were called for in the March 1995 National Marine Fisheries Service biological opinion on hydropower operations.

Improvements at the juvenile bypass systems in the Corps' lower Columbia and Snake river dams may have had an influence. For instance, extended screens installed in front of the turbines at some projects guided a greater percentage of juvenile fish away from the turbine intakes and through the bypass systems.

It is too early for celebrating, however. The 1996 outmigration of juvenile fish was one of the poorest on record, and the "jack" counts this year are not encouraging. Jacks are precocious male salmon that return to the spawning grounds after only a year in the ocean. Their numbers are usually a pretty good indicator of the adult returns for the following year. Jack numbers this year are pretty low, so next year's adult returns may reflect a similar trend. Also, there is another El Nino already setting up. Early indications are that this El Nino may be severe.

It's not time to let down our guard, says the Corps' Doug Arndt. Arndt is a senior manager in the salmon program at the North Pacific regional office. "The region must continue to improve conditions for salmon in the freshwater habitat areas. But we can't do anything to prevent the overwhelming effect of an El Nino. Where we can have an influence, we want to do the best we can to improve conditions for these fish."

High Spring Flows Bring High Spill

As predicted, river operators were real busy this spring handling high inflows at the dams, operating for flood control while providing flows for fish, and doing whatever possible to manage spill at the dams.

Although spilling water over dam spillways is considered a safe way to get juvenile fish past the dams, high levels of spill can cause problems for fish and other aquatic life due to high levels of gas supersaturation. Spilled water plunges into the stilling basin below the dam, entraining air and gases such as nitrogen that can then enter into fishes' vascular systems and cause injury.

In periods of very high water in the river, such as we have seen this year, turbine capacities are exceeded and large amounts of water may be spilled over the dams. The ability to put water through turbines is further diminished when demand for electricity is low and turbines are shut down, or when turbines are down for repair. Spill has been so high that total dissolved gas, or TDG, levels in the water below the dams have often exceeded 130 percent and occasionally 140 percent.

Flow Deflectors Help Control TDG

This year the Corps installed flow deflectors in four of the spillway bays at Ice Harbor Dam before the start of the juvenile fish migration season. Flow deflectors break the fall of spilled water and cause a more horizontal flow, decreasing the amount of gas supersaturation. Corps engineers have looked at data from the gas monitoring stations at Ice Harbor Dam from last year, and compared it to the data coming in this year from the monitoring stations.

The engineers note a marked improvement—TDG levels decreased as much as ten percent at similar levels of spill. When spill is high, TDG still exceeds safe levels, but the improvement is encouraging. Ice Harbor will have deflectors installed at four and possibly six more spillway bays over the next year. Deflectors are also being installed

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at John Day Dam, and are in place at five other Corps dams in the lower Columbia and Snake rivers.

The Corps is evaluating other options for decreasing gas supersaturation during high spill. One is raising the level of the stilling basins, the area below the spillways into which spill falls. Submerged conduits for passing water directly from forebay to tailrace without spilling is another possibility, although similar types of structures tested in the past have been problematic because of high water velocity and attendant injury to fish. These evaluations are part of the systemwide studies for long-term improvements outlined in the National Marine Fisheries Service biological opinion.

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